

The opinion in support of the decision being entered today was not written for publication and is not binding precedent of the Board.

Paper No. 33

UNITED STATES PATENT AND TRADEMARK OFFICE

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U.S. PATENT AND TRADEMARK OFFICE  
BOARD OF PATENT APPEALS  
AND INTERFERENCES

BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

*Ex parte* DANIEL M. KINZER

Appeal No. 2004-1428  
Application 09/292,186

ON BRIEF

Before FLEMING, OWENS and BARRY, *Administrative Patent Judges*.  
OWENS, *Administrative Patent Judge*.

DECISION ON APPEAL

This appeal is from a nonfinal rejection of claims 1, 3-6, 8-13 and 20-22, which are all of the claims pending in the application.<sup>1</sup>

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<sup>1</sup>In an appeal in which claims have been at least twice rejected, the board has jurisdiction as discussed in *Ex parte Lemoine*, 46 USPQ2d 1432 (Bd. Pat. App. & Int. 1995).

### THE INVENTION

The appellant claims a trench-type p-channel power MOSFET which, the appellant states (specification, page 1, line 13), has reduced switching loss. Claim 1 is illustrative:

1. A trench-type power MOSFET having a vertical invertible channel composed of N type conductivity material and disposed between a source region and a drain region; a gate oxide and gate contact thereon extending along the length of said invertible channel and operable to invert the conductivity type of said invertible channel; said gate contact containing a P type conductivity material; said vertical invertible channel material having a constant concentration along its full length.

### THE REFERENCES

Darwish et al. (Darwish)	5,674,766	Oct. 7, 1997
Floyd et al. (Floyd '043)	6,069,043	May 30, 2000
	(effective filing date	Mar. 31, 1995)
Floyd et al. (Floyd '716)	6,090,716	Jul. 18, 2000
		(filed Dec. 17, 1996)

### THE REJECTION

Claims 1, 3-6, 8-13 and 20-22 stand rejected under 35 U.S.C. § 103 as being obvious over Floyd '716.<sup>2</sup>

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<sup>2</sup> In the rejection the examiner also relies upon Floyd '043 and Darwish. These references were relied upon by the examiner in the most recent rejection (mailed December 3, 2002, paper no. 24), and are discussed by the appellant in the brief. The appellant, therefore, has not been prejudiced by the examiner's failure to include Floyd '043 and Darwish in the statement of the rejection. We therefore consider Floyd '043 and Darwish to be before us for consideration.

OPINION

We affirm the aforementioned rejection.

The appellant states that the claims stand or fall in three groups: 1) claims 1, 3 and 20; 2) claims 4-6, 8 and 21; and 3) claims 9-13 and 22 (brief, page 3). We therefore limit our discussion to one claim in each group, i.e., claims 1, 4 and 9, which are all of the independent claims. See *In re Ochiai*, 71 F.3d 1565, 1566 n.2, 37 USPQ2d 1127, 1129 n.2 (Fed. Cir. 1995); 37 CFR § 1.192(c)(7) (1997).

*Claims 1 and 9*

It is undisputed that Floyd '716 discloses a trench-type power MOSFET which differs from that claimed in the appellant's claims 1 and 9 only in that the Floyd '716 MOSFET is an n-channel MOSFET (n-p-n polarity) whereas the appellant's MOSFET is a p-channel MOSFET (p-n-p polarity).

Floyd '043 teaches that a disclosed p-channel trench-type power MOSFET (figure 11) is a complement of a disclosed n-channel trench-type power MOSFET (figure 3) (col. 1, lines 18-23; col. 7, lines 11-17).

Darwish teaches that the principles of the disclosed n-channel trench-type power MOSFETs are applicable to p-channel trench-type power MOSFETs (col. 1, lines 18-21; col. 11, lines 20-22).

The appellant argues, in reliance upon a Rule 132 declaration by Ritu Sodhi (filed September 9, 2002, paper no. 22), that there are numerous differences and difficulties encountered in modifying a device to have a reverse polarity (brief, pages 7-8).<sup>3</sup> Sodhi argues: "The differences between the MOSFET device disclosed by Floyd et al. ['716] and the one presented in this patent [application] are significant. A number of additional steps and further design effort would have to be undertaken to obtain a workable P-channel device following a polarity conversion of the N-channel MOSFET device disclosed by Floyd et al." (paragraph 6). Sodhi then points out five differences between the structures of Floyd '716 and the appellant, but Sodhi does not show that any such differences are due to MOSFET polarity.

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<sup>3</sup> The appellant's reply brief (filed January 26, 2004, paper no. 29) has not been entered (examiner's communication mailed April 14, 2004, paper no. 31) and, therefore, is not before us.

Sodhi argues:

7. In addition, fabrication of a P-channel vertical trench-type MOSFET device is more challenging than the construction of an N-channel vertical trench-type MOSFET device. For example, in N-channel devices, the substrate is an Arsenic-doped material. In P-channel devices, the substrate is Boron-doped material. During the various thermal steps needed to fabricate the MOSFET, Boron from P-channel substrates out-diffuses into the N-type epi region much more readily than Arsenic from N-channel substrates. Since the MOSFET channel is defined by this epi, any variation in the out-diffusion directly impacts the blocking capability and the threshold voltage of the device. In addition, the doping in the polysilicon needs to be carefully optimized to better control the threshold voltage of the P-channel device. Hence, there is more control and characterization needed for P-channel MOSFETs, in particular if a rugged and stable device is to be produced.

8. Accordingly, notwithstanding the contention by the Patent Examiner that a MOSFET design that works under one polarity type is also normally workable under the reverse polarity, a number of additional steps and experimentation must be undertaken to construct a P-channel vertical trench-type MOSFET in accordance with the disclosure of the present invention. The additional steps and experimentation required represent a significant design challenge and require far more sophistication than merely reversing the polarity of an N-channel device.

Sodhi, however, has not shown that one of ordinary skill in the art, given the indications by Floyd '043 and Darwish that n-channel and p-channel trench-type MOSFETs are alternatives to each other, would have been unable, through no more than routine experimentation, to adjust for the differences in out-diffusion

of boron and arsenic and to carry out the design changes needed to reverse the polarity type of the Floyd '716 n-channel trench-type MOSFET.

The appellant argues that because it was well known to those of ordinary skill in the art that electrons have greater mobility than holes, a polar complement would have been unobvious to such a person (brief, pages 5-7). The appellant, however, has not provided evidence that one of ordinary skill in the art would have been unable, through no more than routine experimentation, to adjust for that mobility difference.

The appellant argues that a comparison of the tables on pages 3 and 4 of the specification shows unexpected results (brief, pages 6-7). This argument is not persuasive for the following reasons.

First, the appellant's evidence does not provide a comparison of the claimed invention with the closest prior art. *See In re Baxter Travenol Labs.*, 952 F.2d 388, 392, 21 USPQ2d 1281, 1285 (Fed. Cir. 1991); *In re De Blauwe*, 736 F.2d 699, 705, 222 USPQ 191, 196 (Fed. Cir. 1984). The appellant compares the invention to prior art p-channel MOSFETs rather than comparing the invention to the Floyd '716 n-channel MOSFET.

Second, it is not enough for the appellant to show that the results for the appellant's invention and the comparative examples differ. The difference must be shown to be an unexpected difference. See *In re Freeman*, 474 F.2d 1318, 1324, 177 USPQ 139, 143 (CCPA 1973); *In re Klosak*, 455 F.2d 1077, 1080, 173 USPQ 14, 16 (CCPA 1972). The appellant has eliminated the prior art lightly doped p-type epitaxial layer (21 in figure 1) which, the appellant states, results in a fairly large resistive drop and is a major component of the on-resistance (specification, page 3, lines 26-28; page 4, lines 5-13). Thus, it reasonably appears that reduction in on-resistance resulting from the elimination of that layer would have been expected, rather than unexpected, by one of ordinary skill in the art.

The appellant argues that the Sodhi declaration, which presents evidence of sales in excess of \$6,000,000 of products incorporating the claimed technology (paragraphs 9-10), provides evidence of commercial success (brief, pages 11-12). That argument is not convincing because the declaration does not show a nexus between the sales and the technical merits of the claimed invention, i.e., that the sales resulted from the recited characteristics of the claimed invention rather than from another factor such as features of the product not related to the claimed

subject matter, low price, marketing and salesmanship, customer service, or a prior business relationship between the company and its customers. See *In re Huang*, 100 F.3d 135, 140, 40 USPQ2d 1685, 1689-90 (Fed. Cir. 1996); *Kansas Jack, Inc. v. Kuhn*, 719 F.2d 1144, 1151, 219 USPQ 857, 861 (Fed. Cir. 1983). Also, the declaration does not provide evidence of market share, growth in market share, or replacing earlier units sold by others. See *Kansas Jack, Inc. v. Kuhn*, 719 F.2d at 1151, 219 USPQ at 861.

For the above reasons we conclude that the invention claimed in the appellant's claims 1 and 9 would have been obvious to one of ordinary skill in the art within the meaning of 35 U.S.C. § 103. Accordingly, we affirm the rejection of those claims and claims 3, 10-13, 20 and 22 that stand or fall therewith.

#### *Claim 4*

Claim 4 requires that the MOSFET has reduced on-resistance. The appellant argues that reversing the polarity of the Floyd '716 n-channel MOSFET would produce a p-channel MOSFET having increased on-resistance compared to the n-channel MOSFET because p-channel MOSFETs have lower carrier mobility and other difficulties with processing parameters (brief, page 9). The only reduction in on-resistance which the appellant has demonstrated for his p-channel MOSFET, however, is a reduction



relative to the prior art p-channel MOSFET (specification, tables on pages 3-4). Thus, the relevant question is whether the Floyd '716 p-channel MOSFET would have reduced on-resistance relative to the prior art p-channel MOSFET. Because the Floyd '716 p-channel MOSFET obtained by reversing the polarity of the n-channel MOSFET would not have the prior art lightly doped p-type epitaxial layer which, the appellant states, results in a fairly large resistive drop and is a major component of the on-resistance (specification, page 3, lines 26-28; page 4, lines 5-13), it reasonably appears that the Floyd '716 p-channel MOSFET would have reduced on-resistance compared to the prior art p-channel MOSFET.

We therefore affirm the rejection of claim 4 and claims 5, 6, 8 and 21 that stand or fall therewith.

*DECISION*

The rejection of claims 1, 3-6, 8-13 and 20-22 under 35 U.S.C. § 103 over Floyd '716 is affirmed.

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No time period for taking any subsequent action in connection with this appeal may be extended under 37 CFR § 1.136(a).

*AFFIRMED*

*Michael R. Fleming*  
MICHAEL R. FLEMING

MICHAEL R. FLEMING  
Administrative Patent Judge

Terry J. Owens

TERRY J. OWENS  
Administrative Patent Judge

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~~LANCE LEONARD BARRY~~

Administrative Patent Judge

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